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(71) Applicant: Bals, Edward Julius
Delamere House Tedstone Delamere
Bromyard Herefordshire HR7 4PS(GB)

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(72) Inventor: Bals, Edward Julius
Delamere House Tedstone Delamere
Bromyard Herefordshire HR7 4PS(GB)

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(74) Representative: Mosey, Stephen George et al,
Marks & Clerk Alpha Tower Suffolk Street Queensway
Birmingham B1 1TT(GB)

(54) Sprayhead for electrostatic spraying.

(57) A sprayhead for electrostatic spraying comprises an outer, non-conductive frusto-conical member (2) having channels (17) in its interior surface. An inner member (1) having two frusto-conical outer surface portions (7, 8) separated by step is fitted within said outer member (2) with one of the surface portions (7) engaging the interior surface of the outer member (2). In use, fluid flows through a flow pipe (10) to the channels through a groove (12) in the end of a stem of a metal screw (11) which secures the inner member (1) in position, the stem end being screw-threadedly engaged in the pipe (10).

The pipe (10) is electrically charged and this charge is conducted therefrom through the screw to the metal inner member (1). Thus as fluid flows in the channels (17) in contact with surface portion (7) it is charged so that electrostatically charged spray droplets are produced at an edge (3) of the non-conducting outer member (2).

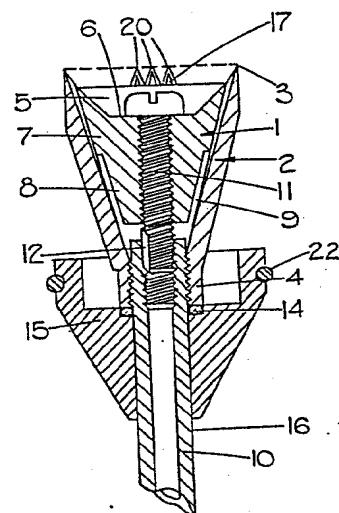


FIG. I.

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"Sprayhead for Electrostatic Spraying"

This invention relates to a sprayhead for the electrostatic spraying of fluid, in particular the electrostatic spraying of agricultural chemicals such
5 as pesticides.

The object of the invention is to provide an improved sprayhead for increasing the degree of control of droplet formation and spray characteristics, as well as enhancing spray deposition, particularly with smaller
10 spray droplets.

According to the invention a sprayhead for the electrostatic spraying of fluid is characterised by an outer member of electrically insulating material having a plurality of fluid flow channels formed in its
15 interior surface, an inner member within said outer member and over at least a portion of its outer surface nearest the discharge end of the sprayhead being in contact with said interior surface of the outer member,
but terminating short of said ^{end,} so that, in use, fluid
20 flows in said channels between said outer member and said portion of the outer surface of the inner member, the outer member terminating in a sharp edge or point as the region of spray formation, and said inner member and/or said fluid being electrostatically charged, in
25 use.

Fluid covers any form of substance capable of being sprayed, which is subject to certain electrical resistivity limitations.

The invention will now be described, by way of example, with reference to the accompanying drawings, in which:-
30

- 2 -

Figure 1 is a fragmentary part-sectional view showing a sprayhead of the invention;

5 Figure 2 is a plan view of some of the grooves in the interior surface of the outer member of the sprayhead; and

10 Figure 3 is a cross-sectional view showing how the depth of a groove increases towards the open end of the outer member, and how different sizes of an inner member of the sprayhead can alternatively fit in the outer member to vary the flow rate.

Figure 1 shows the non-rotatable sprayhead comprising an inner part 1, of electrically conductive material, such as aluminium, within an outer part 2 of plastics or any other non-conductive material.

15 The outer part 2 is of hollow frusto-conical form having a sharp peripheral edge 3 at its liquid discharge end. At its other end the outer part has a short hexagonal part 4 which is internally threaded.

20 The inner part 1 fits within the outer part 2 and substantially conforms externally in shape to the internal shape of the outer part 2. The inner part 1 has a recess 5 in its outer end surface providing a central flat circular surface 6 and substantially half-way along its external surface it is stepped to provide outer and inner frusto-conical surface portions 7 and 8 respectively. The external surface of the outer portion 7 contacts the interior surface of the outer part 2, while the inner portion 8 is spaced from it to provide a clearance 9. The inner part 1 terminates at 25 its inner end above the part 4 of the outer member, and at its outer end terminates short of a point 13, which

will be described hereinafter in relation to the interior surface of the outer part 2.

An electrically conductive liquid supply pipe 10 extends through the part 4 into the interior of the 5 outer part 2 to terminate spaced from the inner part 1. The internal threads of the part 4 contact the outer surface of the pipe 10 and a headed metal screw 11 secures the inner part 1 to the pipe 10.

A head of the screw fits in the recess 5 and engages on 10 the flat surface 6. The stem of the screw passes through a central hole in the inner part 1. The end of the stem screw-threadedly engages in a threaded end of the pipe 10, but a groove 12 in the threads of the stem extends from the end of the stem to a position clear of 15 the end of the pipe 10.

The bottom of the part 4 contacts a seal 14 in an insulating shoulder part 15. The part 15 is externally grooved and carries an insulated earthwire 22. The pipe 10, which is surrounded by electrical insulation upto 20 part 15, is connected to a high voltage supply at 16 and, in use, the liquid to be sprayed is supplied to the pipe 10. For optimum spray formation the voltage should be at least 20 KV. The wire 22 serves to intensify the electrostatic field.

25 The interior surface of the outer part 2 is formed with a plurality of V-shaped channels or grooves 17 moulded therein, the grooves extending substantially in radial planes. Each groove, as shown in Figures 2 and 3, increases constantly in depth and width. The sides 18 30 of each groove 17 run out at said point 13 at the top of each groove, but such sides are effectively continued by respective surfaces 19 at 45° to the outer

part 2, which converge to meet at the top of the outer part 2 to form teeth 20 aligned with the grooves at the end thereof.

Thus over the outer portion 7 of the inner part its external surface contacts the sides 18 of the grooves 17. Since the grooves increase constantly in width and depth, this allows the rate of flow of liquid to the discharge end of the sprayhead to be varied by arranging the step between portions 7 and 8 to be at different longitudinal positions along the inner part 1. Thus several differently stepped inner parts 1 can be provided for the sprayhead, each providing a different flow rate when fitted in said outer part 2. Replacement of one part 1 by another is easily accomplished as it requires a simple removal of the screw 11 and replacement thereof once the differently stepped part 1 is inserted in the part 2.

Figure 3 shows schematically in full lines an inner part 1 having an annular edge 21 at the step between the portions 7 and 8. The fluid flowing into the outer member 2 from the pipe 10 is thus constricted at said edge to flow in the grooves 17 which are of a certain depth and width adjacent the edge 21 producing a certain flow rate.

In dashed lines is shown the arrangement with an alternative inner member 1 where the edge 21a between the portions 7 and 8 is much nearer the top of the outer member 2. Accordingly the depth and width of each groove adjacent the edge 21a is larger than adjacent the edge 21 and thus the rate of flow is greater. In each case, however, the portion 7 of each inner member engages the sides 18 along the whole length of said portion to ensure that the grooves are fed

independently. This allows the sprayhead to be used in all orientations, i.e. in a horizontal orientation there is no danger of fluid collecting in the lower grooves only, the grooves also ensuring an even supply 5. of liquid to each tooth. This allows the sprayhead to be used in many different devices, including co-axial mounting in an air blast device, for multiple purpose spray applications.

Figure 2 shows the positions of the edges 21, 21a and 10 from Figures 2 and 3 it can clearly be seen how the area of each groove at a position adjacent edge 21a is greater than at a position adjacent edge 21.

Thus merely by changing from one insert to another, the flow rate of the sprayhead can be altered as required.

15. A purchaser of the sprayhead would normally buy the sprayhead fitted with an insert giving a certain flow rate for a certain liquid, with there also being provided one or more additional inserts giving different flow rates for the same liquid or still 20 different flow rates for liquids of different viscosities. Such inserts could be marked for identification, for example by colour-coding.

In use, liquid is supplied to the pipe 10, which is connected to the high voltage supply at 16, and such 25 liquid can flow from the pipe 10 through the groove 12 into the clearance 9.

The liquid is then constrained to flow in the grooves 17 on reaching the step between portions 7 and 8 and the spray is formed as ligaments from the edge 3. 30 Electrostatic charging of the liquid occurs by way of the inner part 1, which receives charge via the screw 11 and pipe 10.

Instead of charging the inner part 1, the liquid itself could be charged and the part 1 could then be non-conductive.

- 5 Although the liquid is electrostatically charged, spray formation is from the non-conductive outer part 2 and specifically from the teeth 20 at edge 3. The use of teeth as zero issuing points to improve spray formation by minimising the surface tension forces holding the spray liquid to the sprayhead can be applied to
- 10 electrostatic spraying, as described, by the use of a non-conducting spray forming part. If, instead, the teeth were made of conductive material, they would act as discharge points, leading to a leakage of charge and the disruption of spray formation.
- 15 The sprayhead is simple in construction, with the inner part quickly and easily replaceable as described to alter the flow rate. In addition the outer part is also easily replaceable if the teeth become damaged. The described discharge of electrically charged liquid from
- 20 teeth of non-conductive material is believed particularly advantageous, as is the ability to spray in any orientation.

CLAIMS

1. A sprayhead for the electrostatic spraying of fluid characterised by an outer member (2) of electrically insulating material having a plurality of fluid flow channels (17) formed in its interior surface (18), an inner member (1) within said outer member and over at least a portion (7) of its outer surface nearest the discharge end of the sprayhead being in contact with said interior surface (18) ^{end,} of the outer member (2), but terminating short of ~~said~~ so that, in use, fluid flows in said channels between said outer member (2) and said portion (7) of the outer surface of the inner member, the outer member terminating in a sharp edge or point (20) as the region of spray formation, and said inner member and/or said fluid being electrostatically charged, in use.
2. A sprayhead according to Claim 1, characterised in that fluid is supplied, in use, into said outer member through an electrically conductive feed pipe (10) which is screw-threadedly engaged in a cylindrical part (4) of the outer member extending from the end thereof remote from its end at which the spray is discharged, in use, and in that said inner member is of electrically conductive material.
3. A sprayhead according to claim 2, characterised in that an electrically conductive fixing element (11) conducts charge supplied to said feed pipe (10), in use, to said inner member (1) and secures said inner member in position in said outer member (2).
4. A sprayhead according to claim 3, characterised in that said fixing element (11) is a headed screw, a stem of which extends through a hole in the inner member (1)

and is engaged in a threaded end of the feed pipe, the head of the screw engaging a surface of the inner member (1) facing out of the sprayhead and thereby retaining it in the outer member (2).

- 5 5. A sprayhead according to claim 4, characterised in that from the end of said screw remote from said head a groove (12) extends in the threads of the screw to a position clear of the feed tube (11) to allow fluid to flow, in use, from the tube into the outer member.
- 10 6. A sprayhead according to any one of the preceding claims, characterised in that each fluid flow channel (17) increases in width and depth towards said point of spray formation.
- 15 7. A sprayhead according to claim 6, wherein said outer member (2) has a frusto-conical interior surface, the sprayhead being characterised in that said outer surface portion of said inner member (1) in contact with the interior surface of the outer member is separated by a step from the remainder of its outer surface, so that said remainder is spaced inwardly from the interior surface of said outer member, the step defining an edge (21, 21a) which, in use, constricts fluid within the outer member to flow in said channels (17), ensuring an even supply of liquid to each tooth irrespective of the orientation of the sprayhead.
- 20 25 8. A sprayhead according to claim 7, characterised in that the interior surface of the outer member (2) and both outer surfaces of the inner member (1) separated by said step are cylindrical in transverse cross-section.

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FIG.3.

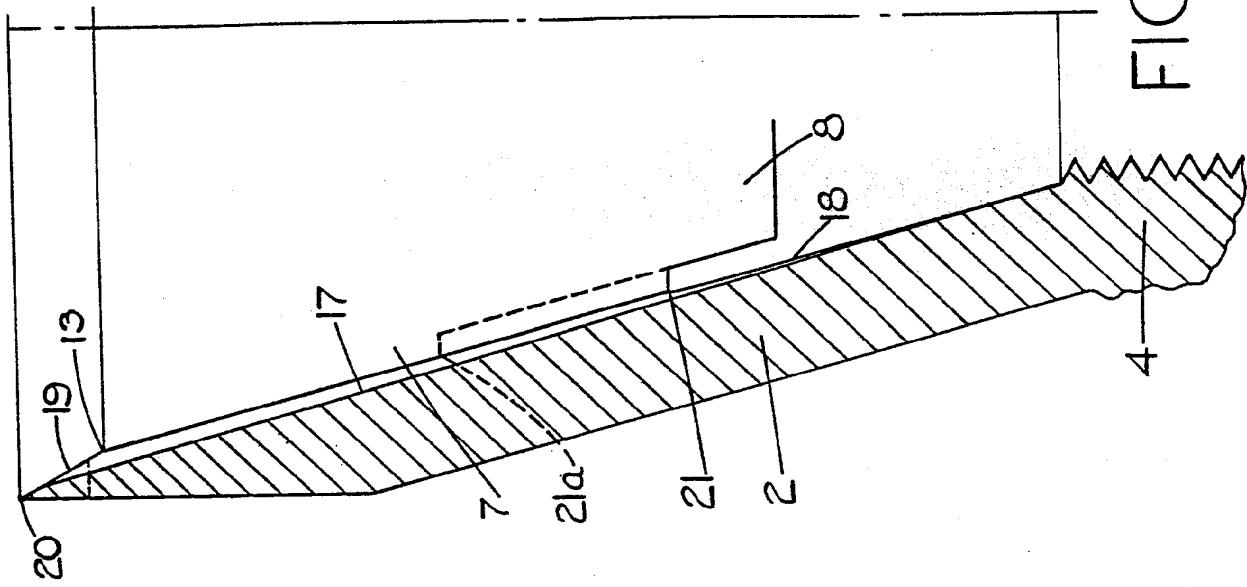


FIG.2.

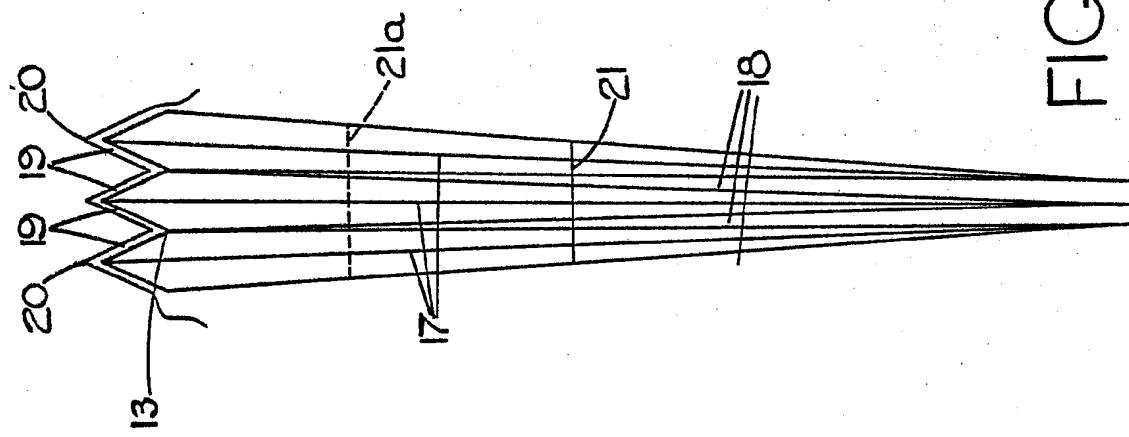


FIG.1.

